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Storage and Handling of High Moisture Co-Products from Ethanol Production in Beef Operations—Beef Producer Study

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Beef Producer Study

A.S. Leaflet R2416

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Summary

The use of corn co-products in beef feeding operations has greatly increased over recent years because of the booming ethanol industry; however, little is known about efficient transportation, storage, and handling of the product. Problems associated with these areas cost beef producer's time and money. In an effort to find out more information, 164 surveys were sent out to veterinarians and feed specialists throughout the state of Iowa to identify the transportation, storage, and handling procedures, trends, and problems associated with the use of co-products as a feed ingredient. The results of the surveys conclude that various types of co-products are used throughout the beef industry, and the methods of transporting, storing, and handling them varies greatly. Additionally, the quality and physical characteristics of the co-products challenge the mixing and storability of the co-product. With this, standards for co-products grading and spoilage determination are two major recommendations resulting from this study.

Introduction

Over the past few years, the corn ethanol industry has experienced exponential growth resulting in large amounts of feed co-products. The beef industry has found these co-products are a good alternative feed source. Because of the increased availability of the ethanol co-products and due to part of them being high moisture, storage and handling have become important aspects of operation management.

Distillers grains are acknowledged as an ethanol by-product that is produced after the fermentation process is completed and the alcohol and carbon dioxide are removed. There are three main types of distillers grains: wet distillers grains (WDG), dry distillers grains (DDG), and wet and dry distillers grains with solubles (DDGS/WDGS). The main difference between DDG and WDG is that DDG are dried to decrease the moisture content from 60-70% to 10%. This drying process increases the cost, but also helps preserve the product for storage and shipment. DDGS/WDGS is distillers grains with the condensed distiller's soluble (CDS or syrup) co-product added. High Moisture Co-Products are defined as any product containing more than 50% moisture.

Ethanol plants in North America are producing about 12.5 million metric tons (13.8 million standard tons) of distiller's grains each year. With the increase in ethanol production, this number is predicted to reach 38 million metric tons (41.8 million standard tons) per year. Because of this, the livestock industry has acknowledged the feeding potential of these ethanol co-products.

Materials and Methods

Recognizing the limited information available on the storage, handling, and transportation of high moisture co-products to beef producers, and with marginal knowledge that veterinarians and feed specialists have on the subject, a joint effort by the Iowa Beef Center (IBC) and three senior undergraduate students from the Agricultural & Biosystems Engineering Department at Iowa State University was established. Through these effort, a survey study to determine common practices and procedures of how high moisture co-products are stored and handled, determine problems users have with them, and to discover areas for equipment and practice improvement.

Two surveys were developed and sent out to two main groups of people in the beef industry- Producers, and Veterinarians/ Feed Specialists. Producers were defined as those people who own/operate a beef production operation. Veterinarians were defined as the certified professionals on the expertise of the health and management suggestions to such producers. Feed Specialists were defined as suppliers of additives and supplements to producers.

Through the work of the IBC and the students, topics of interest were generated under the general categories of handling, storage, and transportation of high moisture co-products. These were noted as important issues to the beef industry. Determining factors for key issues were: common practices used by producers, known problems associated with high moisture co-products, research advancements in this area, and the collective knowledge of the IBC and the undergraduate students. After narrowing these topics down to the most pertinent issues currently needing attention, questions were generated regarding high moisture co-products storage practices, transportation, handling, and general management practices by Producers and Veterinarians/Feed Specialists.

The surveys were mailed to beef producers from a list which the IBC had used from previous mailings. The IBC extension field livestock specialist formed a new list of veterinarians and feed specialists which they consented to the use of the study. In total, 2,309 surveys were mailed to the different groups; 2,145 of these went to the Producers, and 164 went to the Veterinarians and Feed Specialists. Of the total Beef Producer surveys that were sent out, 337 were returned; resulting in a 16% return rate however; only 228 surveys contained usable data to evaluate due to incomplete surveys returned. The completed surveys were returned to the IBC for analysis to determine trends associated with common practices and problems with the use of high moisture co-products as a feedstuff. Respondents were allowed to choose or select more than one answer for many of the questions; therefore, percentages do not add up to 100% for each question.

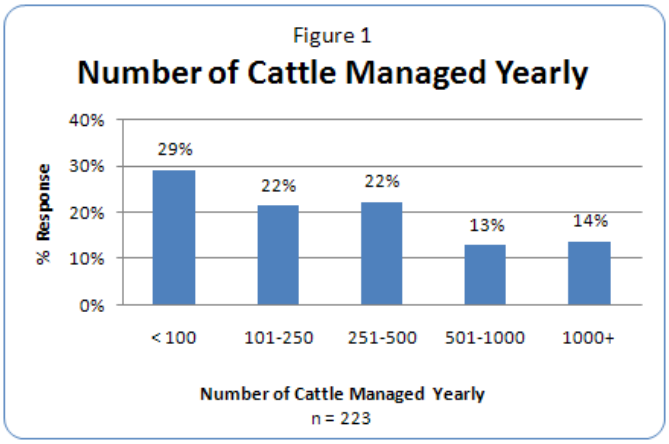
The targeted geographic area was based in Iowa, with a few exceptions located in neighboring states, allowing for members of the three focus groups who had their operations located outside of Iowa.

Results and Discussion

The majority of beef producers surveyed own/manage cow-calf herds and feedlots with sizes of these operations to be evenly distributed. Size distribution of operations in this study can be found in Figure 1. As seen in Figure 2, WDGS have the highest usage among these types of operations. High moisture co-products, such as WDGS, CDS, and Wet Corn Gluten Feed are currently used by 46% of beef producers.

High moisture co-products are not used by many cattle producers; 44% of respondents to the survey do not currently feed them and 11% used to, but have since discontinued. Some of the reasons producers have stopped feeding high moisture co-products are: storage, delivery to animals, cost, inconsistency in product, and health changes of the animals.

Figure 1



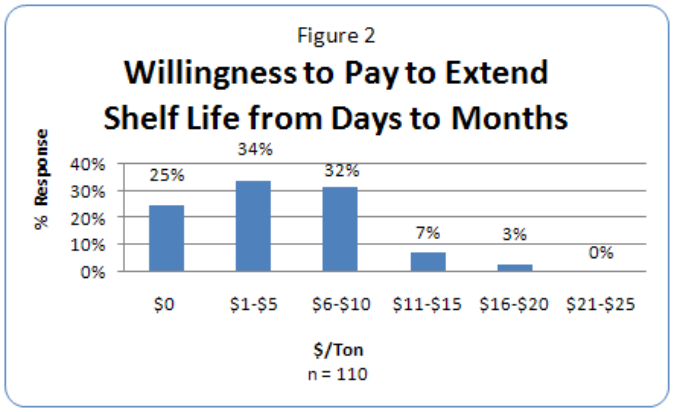
Wet Co-Product Storage

Nearly 80% of those who responded stated that fresh pile is their primary practice of wet co-product storage. The remaining respondents used piles with plastic or additives, upright silos, and forage sheds or silos as wet co-product storage practices. The top four practices beef producers were willing to change in order to extend the life of the co-product are preservatives (chemical & biological), temporary storage (silage bags/plastic cover), permanent storage surface (concrete slab), and mixing with other feeds. The producer's willingness to spend additional dollars per ton of co-product for life extension methods can be seen in Figure 2. Fifty-eight percent of respondents will not pay over $5 per ton to extend the shelf life of the product.

Table 1
Distribution of Co-Product Purchases by Volume

	% of Producers Purchasing Each Co-products			
Product	**Tons or Loads/Year**			
	< 250 T 10 loads	250-650 T 11-25 loads	650-1300 T 26-52 loads	> 1300 T >52 loads
DDGS	25%	3%	1%	1%
WDGS	12%	9%	7%	9%
MDGS	9%	8%	4%	6%
CDS (syrup)	12%	3%	1%	2%
Bran Cake	1%	0%	0%	1%
Wet Gluten Feed	8%	6%	4%	6%
Dry Gluten Feed	15%	3%	0%	1%
Other	1%	1%	1%	1%

Figure 2



Spoilage, being one of the most common reasons producers have trouble with storage, was determined by a visual check. Nearly 85% of producers perform this type of check to determine if their co-product is unacceptable for feed use. They also state that between 1 and 10% spoilage is an acceptable amount to discard per load.

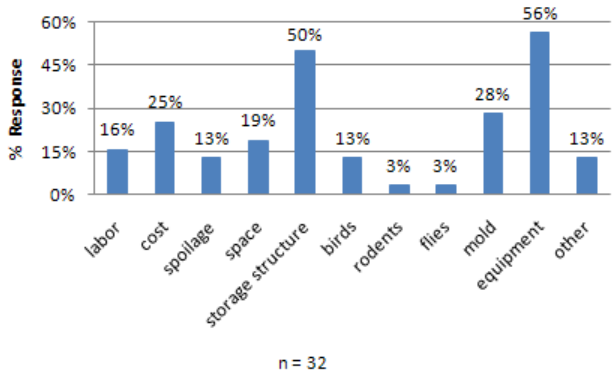
Condensed Distillers Solubles (CDS or Syrup)

While 51% of all respondents store their syrup in above ground unheated tanks, nearly 48% of all respondents reported having trouble with their syrup freezing. This may indicate that above ground unheated tanks are not suitable for adequate storage and protection from freezing when temperatures drop in the fall and winter seasons. Figure 3 shows the top challenges which producers face when storing syrup.

Ration Delivery to Pasture or Grazing Cattle

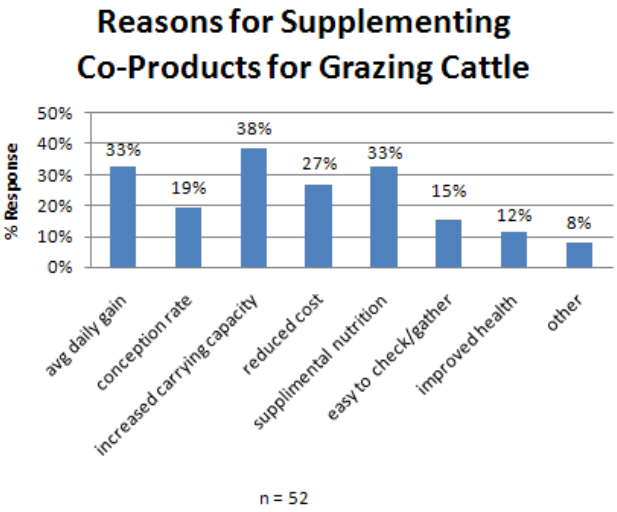
There are many reasons why producers supplement co-products to pasture or grazing cattle. Figure 4 provides the primary reasons for the supplementation. Wet distillers grains (WDG) is the most common co-product fed to these cattle

Figure 3



herds followed by syrup and DDGS. In the producer's opinion, carrying capacity was increased by supplementing co-products with pasture or grazing cattle. Figure 5 shows their estimated increase in carrying capacity resulting from the supplementation of co-products.

Figure 4



Nearly 52% of all respondents stated they feed co-products in feed bunks to their pasture or grazing cattle. Those supplementing with syrup used lick tanks or applied the syrup to roughage as their method of feed delivery. According to 88% of respondents, the estimated loss due to weather and/or cattle trampling or defecation was less than 10%.

Co-product is fed daily by 62% of beef producer respondents. The feeding of co-products to pasture or grazing takes an estimated 1-5 additional hours per week, with most traveling less than one mile from storage to feeding site.

Figure 5

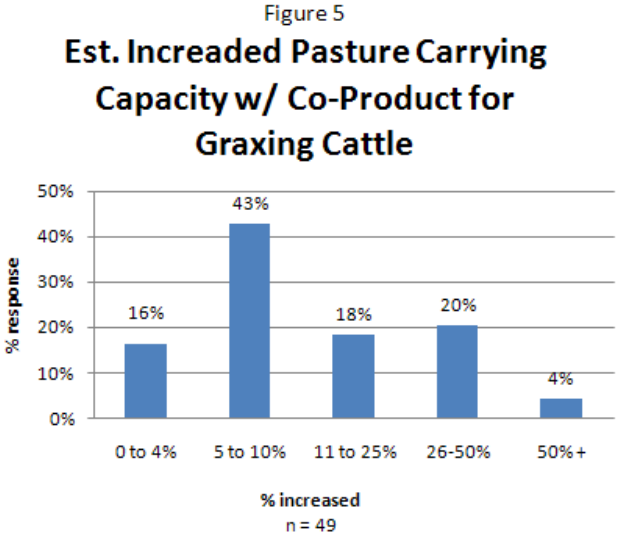


Figure 6

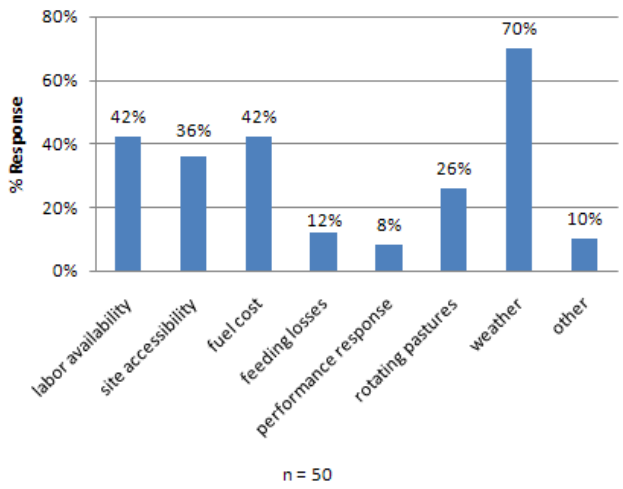
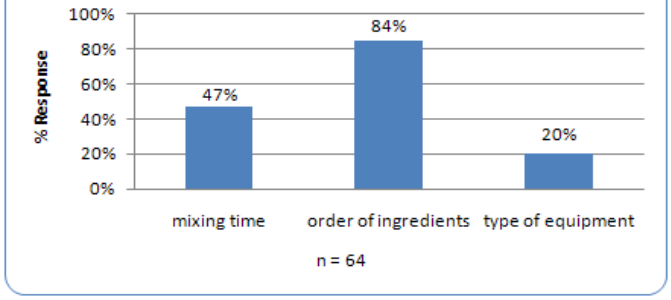


Figure 7



Wet Co-Product Mixing and Delivery

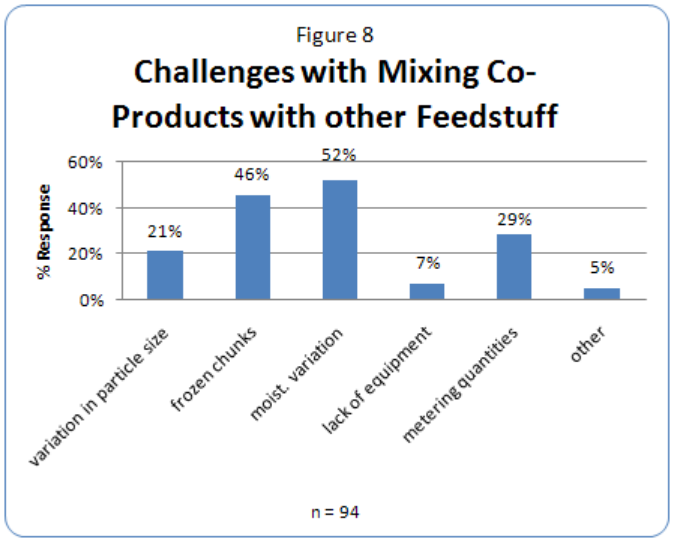
Reel and auger type mixing apparatus are most commonly used to blend co-products with additives and other feedstuffs. A bucket scoop was overwhelmingly the most common method for moving the co-product (92%); however, 7% of producers are using five gallon buckets to manually deliver it.

Problems associated with the use of co-products have caused many producers to adjust their approach toward mixing time, order of ingredients, or type of equipment used. Figure 7 shows the distribution toward three common issues which have resulted in such changes. Inputs from the producers on how to manage these issues include:

- when mixing wet co-products, most producers found it easier to add a dry ingredient (such as corn) first, then mix in the co-product in the middle of the other ingredients or at the end
- mixing syrup in last (Syrup has a tendency to gum up the mixer; mixing syrup in at a different time than a wet co-product is also recommended.)
- increasing mixing time and decreasing mixing speed helped produce a more consistent finished product
- grinding roughage finer than usual to create smaller particle sizes in order to get a more uniformly mixed end product.

The biggest challenge with mixing co-products is variation in moisture; other challenges are indicated in Figure 8. When going from loading to mixing co-products, 59% of producers say they have difficulties with appropriate metering of distillers grains into the mixing system. Other respondents said getting it out of storage (13%), delivery to feed bunk/site (13%), and damage to storage structure during loading are also problems faced with loading and mixing co-products. Seventy eight percent of respondents used reel and auger type mixing apparatuses to blend co-products with additives and other feedstuffs. The other 22% responded using paddle, apron/chain, bale processors or already mixed to process the co-product.

With corroboration from results of **Storage and Handling of High Moisture Co-Products from Ethanol Production in Beef Operations**, some distinct conclusions can be drawn. The information from the Veterinarian and Feed Specialist survey shows that they do not prefer the use of chemical or biological preservatives for extended storage of co-products. In this survey, we found that this means of storage is one of the top methods which producers would prefer for storage extension. Additionally, beef producers tend to combine and mix spoiled co-product with fresh in order to reduce loss due to spoilage, whereas feed specialists and veterinarians prefer separation and discard of spoiled co-product.



All surveyed groups concur that an acceptable amount of spoilage loss should be 1-10% per load. Moisture variation and appropriate metering of co-product are also two challenges that all parties agreed upon as being a challenge in the use of co-products for beef operations.

Implications

Implementing a grading system, with specifications for sulfur, particle size, moisture content, fat & protein levels, would result in uniform classes of co-products, making them more marketable and less variable between truckloads for producers. Additionally, a standard for spoilage is necessary to determine the acceptable amount of spoiled co-product, if any, can be feed to livestock.

Suggested areas of design for easier delivery include:

- Systems for smaller feeders in cow/calf operations to utilize both WDGS and syrup more effectively
- Better flow ability of co-product
- Justifiable cost of equipment
- Liquid tank to unload with air pressure

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